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Self-Regulation Mitigates the Association between Household Chaos and Children's Behavior Problems

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Abstract

Given the potential negative effects that early childhood behavioral problems have on later development, it is important to elucidate risk and protective factors. This study examined household chaos as a predictor of externalizing and internalizing problems among young children from low-income families. Additionally, self-regulation was examined as a moderator of the association between chaos and behavior problems. One hundred young adult mother-toddler dyads participated. Moderation analyses indicated that self-regulation buffered the association between household chaos and child behavior problems. Specifically, greater household chaos was associated with more behavior problems, but only among children with poorer self-regulation. Notably, this pattern was observed for both externalizing and internalizing problems. These findings suggest that early interventions targeting young children's self-regulation skills could help prevent behavior problems among children living in chaotic home environments.

Keywords

household chaos; self-regulation; early childhood; externalizing problems; internalizing problems

Early childhood behavioral problems predict a wide range of later negative outcomes, including psychiatric diagnoses, criminal activity, and various work and social stressors (Hofstra, van der Ende, & Verhulst, 2002; Moffitt, Caspi, Harrington, & Milne, 2002). Accordingly, substantial research efforts have been devoted to identifying and ameliorating the child, parent, and contextual risk factors that contribute to the development of early childhood externalizing (e.g., aggression, defiance) and internalizing (e.g., anxiety, social withdrawal) behavior problems. One risk factor that researchers have increasingly examined

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as a predictor of child behavior problems is household chaos, a multi-faceted construct that includes lack of structure and routines as well as elevated levels of noise, crowding, and disorganization (Evans & Wachs, 2010). The majority of existing research on household chaos and behavior problems has examined associations with children's externalizing problems (e.g., Deater-Deckard et al., 2009), and the more limited literature on associations with internalizing problems has tended to focus on older children and adolescents (e.g., Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005). The present study extends the existing research by focusing on internalizing and externalizing problems among young children raised by young mothers in low-income households, a context in which chaos might be more frequent and persistent.

Moreover, little research has focused on factors that might alter the strength of associations between household chaos and behavior problems. One such factor, self-regulation, has been established in prior research as an important skill for young children, especially in the context of risk (Buckner, Mezzacappa, & Beardslee, 2009). The present study adds to the literature by investigating whether self-regulation, which has functioned as a moderator in prior research on other contextual risk factors and behavior problems (Lengua, Bush, Long, Kovacs, & Trancik, 2008), buffers associations between household chaos and internalizing and externalizing problems. Understanding the interplay between household chaos and children's self-regulation in the early development of behavior problems could inform family-focused interventions and programs to promote young children's self-regulation.

Household Chaos

Influenced by Bronfenbrenner's bioecological model of human development (Bronfenbrenner & Morris, 2006), research on household chaos has examined the home environment as an ecological microsystem that can either foster or inhibit healthy child development (Evans & Wachs, 2010). An operational definition of chaos encompasses two main constructs: instability/turbulence and disorder. Instability/turbulence reflects changes in settings and relationships in the home and the unpredictability of routines. Disorder includes noise, crowding, clutter, and lack of structure (Sameroff, 2010). Though chaos exists in households at all levels of socioeconomic status, factors such as stressful life experiences, shifting work schedules, single parenting, and a lack of resources may contribute to relatively higher levels of chaos in low-income households (Bronfenbrenner & Evans, 2000; Vernon-Feagans, Garrett-Peters, Willoughby, & Mills-Koonce, 2012). Financial insecurity may create instability by forcing families to change settings (e.g., moving in and out of homeless shelters) and by requiring more people to live in the home to support the household. Irregular work schedules place increased demands on childcare, which may require family members to rely on others living in the home. Longitudinal research on adaptation among low-income families demonstrates that the demands of daily life are associated with greater chaos, including household overcrowding, instability in household composition, and changes in parenting partners (Lichter & Jensen, 2002; Tubbs, Roy, & Burton, 2005). Further, chaos indicators are increasing more rapidly among low-income families compared to middle income families, and poverty-related chaos places restraints on upward socioeconomic mobility (Evans et al., 2005).

Environmental unpredictability was a central focus in Wachs's (1986) early studies of chaos, which primarily examined links between aspects of chaos and early cognitive development. He hypothesized that lack of family routines interfered with children's ability to internalize social rules and with parents' ability to interact in meaningful ways with their children. In this seminal work, environmental unpredictability encompassed the regularity of the children's daily schedule, the amount of time the television was on in the home, and the number of people coming in and out of the home. These indicators of chaos predicted poorer cognitive development, above and beyond demographic characteristics. In a more recent study of low-income African American young children, household disorganization predicted lower expressive and receptive language while accounting for demographic variables (Vernon-Feagans et al., 2012), providing further support for chaos as a unique risk factor for early cognitive and language difficulties among at-risk young children.

Chaos and Behavior Problems

Chaos within the home may also contribute to children's behavioral difficulties. For example, in a study of middle class families with school-aged children, chaos accounted for variance in a measure of a broad range of child behavior problems and markedly exacerbated the negative impact of harsh parenting on behavior problems (Coldwell, Pike, & Dunn, 2006). Many studies have exclusively examined associations between chaos and children's externalizing problems (e.g., Deater-Deckard et al., 2009), and there is less evidence to support a link to internalizing problems. However, in one study that focused on internalizing problems in a sample of rural, low-income families with adolescents, chaos was associated with parent- and youth-reported internalizing (and externalizing) problems (Evans et al., 2005).

Some of the research on chaos and behavior problems provides only limited or mixed support for the hypothesized associations between these two constructs. Dumas and colleagues (2005) conducted two studies, each of which focused on a different population: Caucasian families with preschool-aged children and predominantly African American families with school-aged children. In each sample, they found that children living in high chaos environments had more behavioral problems, particularly those related to aggression and other externalizing problems. Chaos was also related to internalizing problems, but only within the sample of African American school-aged children. The researchers theorized that inconsistencies may be due to the age difference between the samples. They speculated that the effects of chaos first manifest early on in life as anger, aggression, and other externalizing problems, but associations with internalizing problems may not become apparent until somewhat later in children's development (Dumas et al., 2005). However, there were multiple differences between the two samples, meaning that it is not possible to definitively state that age differences accounted for the inconsistent associations with internalizing problems across samples.

The most directly comparable research to the present study was conducted with young, primarily ethnic minority toddlers from low-income families (Supplee, Unikel, & Shaw, 2007). In that study, chaotic environments at ages two and three were associated with parent and teacher reported externalizing problems at ages four and five, whereas associations

between neighborhood risk and child externalizing problems were not apparent until the children were school-aged (Supplee et al., 2007). The authors theorized that, compared to neighborhood and community risk, household chaos provides a more salient environmental risk factor for young children, given that they may spend less time outside of the home than their older peers. Unfortunately, internalizing problems were not examined in this prior study. Given the relatively limited evidence for the role chaos in early behavior problems, especially among young children from at-risk families, more research is needed that includes both externalizing and internalizing behavior problems. Research is also needed to uncover potential protective factors that could be fostered by intervention programs to prevent children who live in chaotic home environments from developing behavior problems.

Self-Regulation as a Protective Factor

Though evidence supports that contextual risk factors in early childhood, including household chaos, predict later maladjustment, greater contextual risk is not uniformly associated with behavior problems among all children. On the contrary, many children demonstrate resilience to contextual risk, and these children may show few or no signs of early-emerging psychopathology. A growing evidence base has examined various child characteristics that help shape resiliency in adverse contexts (Kim-Cohen, Moffit, Caspi, & Taylor, 2004; Lengua, 2002). One such protective factor is self-regulation, which is a multi-faceted construct that has been defined as the ability to direct and focus one's actions and/or attention in order to meet one's goals (Flouri, Midouhas, & Joshi, 2014). Self-regulation is especially relevant in emotionally-laden contexts when frustration and other negative emotions may tax developing children's nascent skills at managing their attention and behaviors (Eisenberg, Spinrad, & Smith, 2004).

Examining self-regulation in early childhood is highly relevant from a developmental psychopathology perspective (Calkins & Fox, 2002; Kopp, 1989). Deviations or delays from typical development at earlier stages increase the likelihood of psychopathology in later stages. In other words, children who have difficulty attaining adaptive self-regulation skills in early childhood may display greater social and behavioral problems later on (Gilliom et al., 2002; Trentacosta & Shaw, 2009). On the other hand, at-risk children with adaptive capacities for self-regulation may have fewer adjustment problems and greater overall functioning throughout development (Vanderbilt-Adriance & Shaw, 2008).

Self-regulation may moderate the relation between household chaos and behavior problems by mitigating the experience of distress among children living in chaotic home environments, thus allowing them to divert or focus their attention and energy in adaptive ways. Self-regulation may also serve to temper emotional and behavioral responses to stress, facilitating the use of more effective coping skills (Lengua et al., 2008). Early self-regulation has been linked to positive outcomes such as school readiness, empathy, compliance, and social competence (Blair & Razza, 2007; Eisenberg et al., 2003; Lengua, 2003), and it is negatively associated with child behavior problems (Eisenberg et al., 2010; Lengua, 2003). Moreover, Lengua and colleagues (2008) found that indicators of self-regulation moderated associations between contextual risk and changes in children's internalizing and externalizing problems from ages 8–12 years. Difficulties with self-regulation may be

especially problematic for children from lower-income families who face recurrent and severe stressors (Flouri et al., 2014; Raver, 2004). The present study adds to the existing literature by examining whether self-regulation interacts with the unique risk of household chaos when predicting young children's behavior problems, which could provide insights into how to enhance early interventions.

The Current Study

A growing evidence base suggests that household chaos contributes to child behavior problems. However, further research is needed to examine associations between household chaos and both internalizing and externalizing problems in early childhood and to investigate whether self-regulation might protect children from the harmful impacts of household chaos. The present study examined whether household chaos was associated with children's externalizing and internalizing behavior problems at age 3, while accounting for earlier behavior problems at age 2. This study also investigated associations between observed self-regulation and externalizing and internalizing behavior problems, including the hypothesis that self-regulation would moderate the association between household chaos and behavior problems. More specifically, we expected that higher levels of self-regulation would function as a protective factor by buffering associations between household chaos and both internalizing and externalizing problems. On the other hand, among children with low self-regulation there may be a robust association between household chaos and behavior problems. Traditionally, this pattern of interaction would fit with diathesis-stress or transactional/dual risk frameworks where the combination of low self-regulation and household chaos would be expected to increase the likelihood of behavior problems (Sameroff, 1983). However, recent evidence suggests that the role of low self-regulation in moderation analyses may be consistent with the differential susceptibility framework (Belsky & Pluess, 2009; Kim-Spoon, Haskett, Longo, & Nice, 2012), meaning children with low self-regulation may actually show fewer problems when raised in a nurturing home environment. Therefore, we also explored whether the pattern of moderation fit with the traditional diathesis-stress or dual-risk frameworks or with the differential susceptibility framework.

The present study addressed these hypotheses within a sample of low-income families with young children. The current study's sample is especially unique in that all mothers gave birth at age 21 or younger. Households with adolescent and emerging adult mothers may experience more socioeconomic difficulties, including household chaos, than other homes (Molborn & Dennis, 2012; Trentacosta et al., 2010). For instance, younger mothers are likely to live with other family members for financial and childcare support, and they are more likely to be single parents (Kulkarni, 2006), both of which could increase the level of disorganization and noise in the household. Furthermore, maternal depressive symptoms and parenting behaviors were controlled in the analyses because a sizable body of literature documents associations between these constructs and early problem behaviors (Goodman et al., 2011; Rothbaum & Weisz, 1994).

Method

Participants

Participants were 100 adolescent and young adult mother-toddler dyads who were part of a longitudinal study that was approved by a university's Institutional Review Board. Researchers recruited young mothers in a large U.S. city from Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) sites that serve low-income families. To meet the study's longitudinal requirements, mothers had to have been 21 years or younger when they gave birth to the child participating in the study. Mothers were, on average, 20.4 years of age ($SD = 1.62$) at the initial study visit. Nearly all mothers in the sample (98%) self-identified as Black/African-American or bi-racial/multi-racial and all were of low socioeconomic status given that they qualified for WIC services. The longitudinal study began when toddlers were 18 months and assessed the toddlers at 24 months ($N = 100$; M age = 1.99 years, $SD = 0.05$), and 36 months ($N = 85$; M age = 3.01 years, $SD = 0.03$). There were no significant differences on study variables measured at 24 months when comparing the participants who were assessed at both 24 months and age 36 months and participants who were only assessed at age 24 months (i.e., all p values for independent samples t -tests were $> .05$).

Measures and Procedures

At 24 and 36 months, trained research assistants visited the homes of the mothers and their children. The visits for two families at 24 months were conducted at a research laboratory because it was not possible to visit the participants' homes. The visits were approximately two hours long, and participants received monetary compensation for their time. Mothers completed demographic interviews and numerous questionnaires, including questionnaires assessing household chaos (at 36 months) and child behavior problems (at 24 and 36 months). Researchers video recorded mothers and their children engaging in multiple tasks, including tasks designed to measure children's self-regulation.

Household chaos.—Mothers reported on household chaos at 36 months with the Confusion, Hubbub, and Order Scale (CHAOS; Matheny et al., 1995). This 15-item self-report questionnaire measures environmental confusion in the home, such as high noise levels and overcrowding. Mothers rated items as 1 (*True*) or 0 (*False*) in the current study, and scores represented the total number of *True* responses. Sample items include, “there is very little commotion in our home” (reversed), “we can usually find things when we need them” (reversed), “it’s a real zoo in our home,” “you can’t hear yourself think in our home,” and “I often get drawn into other people’s arguments at home.” Versions of the CHAOS have been used in numerous studies of the role of household chaos in child development (e.g., Coldwell et al., 2006; Shelleby et al., 2014; Wachs, Gurkhas, & Kontos, 2004). Internal reliability was very good in the present study ($\alpha = .73$).

Child behavior problems.—Mothers rated child behavior problems at the 24 and 36 months visits using the Child Behavior Checklist (CBCL) version for ages 1.5 to 5 years (Achenbach & Rescorla, 2000). This measure includes broad-band scales for internalizing and externalizing problems. Items assessing internalizing (example item, “Withdrawn,

doesn't get involved with others") and externalizing ("Defiant") problems were rated on a scale ranging from 0 (*Not True*) to 2 (*Very True or Often True*). We utilized raw sum scores for the current study. The internalizing broad-band scale contains 36 items ($\alpha = .84$ and $.88$ at 24 and 36 months, respectively, in the present sample), and the externalizing broad-band scale contains 24 items ($\alpha = .90$ and $.90$ at 24 and 36 months, respectively, in the present sample)

Child self-regulation.—Videotaped waiting tasks at 24 and 36 months captured child self-regulation behaviors while the child's mother was occupied with questionnaires, but present and in view of the toddler. At the 24-month visit, the waiting task consisted of researchers instructing toddlers to stay out of a box of toys within view of the mother for five minutes. Researchers instructed mothers to react to the toddler however was most comfortable for her, noting only that the toddler could not be in the toy bin. At the 36-month visit, the self-regulation task was similarly structured, with the added component of researchers instructing the toddlers to wait before eating a cookie, and the task lasted three minutes instead of five. The toy bin was present in both self-regulation tasks. Researchers instructed mothers at the beginning of the visit to ensure that the toddler had no extra toys or snacks for the duration of the self-regulation tasks. This was meant to capture the toddler's self-regulation capacity with only the mother's presence for support. Without extra toys and snacks for distraction, the task more accurately captures the interaction between mother and toddler as the toddler waits for the waiting period to end.

Researchers coded self-regulation from the video-recorded waiting tasks in 10 second intervals using Mangold INTERACT (2010). The self-regulation skill codes were labeled either "present" or "not present" or as "behavior not codeable" for unique and rather rare situations where the code could not be captured (e.g., the child temporarily left the room). Coders reviewed the video recording of each 10 second interval to determine whether the child exhibited specific self-regulation behaviors within each interval.

In line with prior research using this coding system (Trentacosta & Shaw, 2009), the present analyses focused on two codes that occurred frequently and are relevant to the development of behavior problems. First, distraction is considered an adaptive self-regulation strategy. Distraction behaviors include fantasy play, singing, and engaging the mother in conversation that is not related to the waiting period. Second, focusing on the delay is the primary form of maladaptive self-regulation and included behaviors such as trying to end the task early, not following the rules of the task, attempting to play with the toys, or reaching for the cookie. Tantrums over the toys or cookie were also considered focus on delay. Each code (distraction and focus on delay) was converted to a proportion score that reflected the proportion of 10 second intervals where the self-regulation behavior was marked as "present."

Trained research assistants coded each task. There were different coding teams for each wave of data collection, and each team consisted of two undergraduate research assistants. Approximately 25 percent of the videos at each wave were coded by both research assistants to assess reliability. Reliability at both waves was excellent ($\kappa = .86$ and $.92$ for

distraction and focus on delay, respectively, at 24 months; kappa = .93 and .97 for distraction and focus on delay, respectively, at 36 months).

Distraction and focus on delay were highly (negatively) correlated at each time point ($r = -.92$, $p < .001$, at 24 months; $r = -.90$, $p < .001$, at 36 months). Therefore, we centered each variable and calculated an inverse score for focus on delay prior to computing a single self-regulation score for each time point that was the average of distraction and the inverse of focus on delay. Because self-regulation at 24 months was non-significantly correlated with self-regulation at 36 months ($r = .19$, $p = .09$), we examined self-regulation at each time point separately in the analyses presented below.

Covariates.—The covariates included in analyses were child sex, observed positive parenting, and mother-reported depressive symptoms. Researchers coded observed positive parenting behaviors in a mother-child interaction “three bags” task at the 24-month visit using the Parenting Interactions with Children Checklist of Observations Linked to Outcomes (PICCOLO; Roggman et al., 2013). The PICCOLO is a checklist of 29 observable positive strategies parents use with children ages 10–47 months that are linked to adaptive child outcomes. Coders rated behaviors on a scale of 0 (*Not at All There*), 1 (*Barely There*), and 2 (*Mostly There*). Example behaviors included “Smiles at child,” “Asks child for information,” and “Verbally encourages child’s efforts.” We conducted analyses with the total positive parenting score, calculated from the sum of all scale items ($\alpha = .85$ in the present study). Mothers completed the Beck Depression Inventory (BDI; Beck, Steer, & Carbin, 1988) at 24 and 36 months. The BDI contains 21 items assessing various symptoms of depression, including sadness, loss of pleasure, pessimism, feelings of worthlessness, and tiredness or fatigue. Given the lack of clinical resources for an immediate follow-up, we omitted the suicidal ideation item from the questionnaire. Respondents rated each item on a 0 to 3 scale, and their total BDI score represented the sum of all items. For the current study analyses, we used a single mean BDI score averaging scores from 24 and 36 months.

Data Analysis Plan

We first conducted descriptive analyses to examine means, standard deviations, and bivariate correlations. Next, we conducted multiple regressions where missing data was handled through listwise deletion. In order to conduct moderation analyses, we created an interaction term using the centered variables for household chaos (the predictor) and self-regulation (the hypothesized moderator). In each regression analysis, we entered predictors and covariates in the first step, and we entered the interaction terms in the second step. We probed statistically significant interaction terms using simple slopes analyses following procedures outlined by Holmbeck (2002). More specifically, we tested and plotted the association between household chaos and behavior problems when self-regulation was 1 *SD* above the mean and when self-regulation was 1 *SD* below the mean. Finally, to assess whether the interaction findings were consistent with the differential susceptibility framework (Belsky & Pluess, 2009), we calculated values for regions of significance with respect to X (RoS X) following procedures described by Roisman and colleagues (2012). RoS X values within ± 2 of the *SD* of the standardized X variable (household chaos) support differential susceptibility. To calculate the RoS X values, we standardized the household chaos and self-

regulation variables prior to running multiple regressions using an online calculator (Fraley, 2012).

Results

Descriptive Statistics and Bivariate Correlations

Table 1 presents means, standard deviations, and ranges for measures. Bivariate correlations (see Table 2) indicated that household chaos was significantly correlated with externalizing and internalizing problems at both 24 and 36 months. Household chaos was not significantly correlated with self-regulation, and self-regulation was also not correlated with externalizing or internalizing problems.

Findings for Externalizing Problems

We conducted multiple regression analyses with household chaos, child self-regulation (either 24 months or 36 months), and the interaction between household chaos and self-regulation as predictors of child behavior problems at 36 months, with separate multiple regressions predicting externalizing and internalizing problems, respectively. We included externalizing/internalizing problems at 24 months, child sex, maternal depressive symptoms, and positive parenting as covariates. We entered all covariates and main effects in the first step of the multiple regression analyses, followed by the household chaos x self-regulation interaction term in the second step.

As shown in Table 3 for the model predicting externalizing problems at 36 months with self-regulation at 36 months as the moderator, high levels of externalizing problems at 24 months predicted high levels of externalizing problems at 36 months. The other main effects were not statistically significant, although household chaos was marginally significantly associated with externalizing problems ($p < .10$). Importantly, a statistically significant interaction term indicated that child self-regulation at 36 months moderated the association between household chaos and child externalizing problems at 36 months.

As shown in Figure 1, a graph of the interaction between household chaos and self-regulation and tests of simple slopes indicated that a statistically significant association between household chaos and externalizing problems was only present when children had low self-regulation. Tests of simple slopes indicated that household chaos was strongly associated with child externalizing problems when children had low self-regulation (i.e., self-regulation 1 *SD* below the mean), $\beta = .30$, $p < .05$, but household chaos was not associated with externalizing problems when children demonstrated high self-regulation (i.e., self-regulation 1 *SD* above the mean), $\beta = .01$, $p > .05$. The RoS X values > -3.00 and .78 did not fully support a differential susceptibility interpretation of this interaction.

In a separate analysis with the same main effects and covariates but including child self-regulation at 24 months as the moderator, the household chaos x self-regulation interaction term was also statistically significant, with a similar pattern of simple slopes (see Table 4 and Figure 2). The RoS X values $-.44$ and 1.06 suggested that the pattern of this interaction fit with the differential susceptibility framework.

Findings for Internalizing Problems

As shown in Table 5 for the model predicting internalizing problems at 36 months with self-regulation at 36 months as the moderator, high levels of internalizing problems at 24 months and maternal depressive symptoms predicted high levels of internalizing problems at 36 months. The other main effects were not statistically significant, although household chaos was marginally significantly associated with internalizing problems ($p < .10$). Moreover, a statistically significant interaction term indicated that child self-regulation at 36 months moderated the association between household chaos and child internalizing problems at 36 months, which parallels the findings uncovered when predicting externalizing problems.

As shown in Figure 3, a graph of the interaction between household chaos and self-regulation and tests of simple slopes indicated that a statistically significant association between household chaos and internalizing problems was only present when children had low levels of self-regulation. Tests of simple slopes indicated that household chaos was strongly associated with child internalizing problems when children had low self-regulation (i.e., self-regulation 1 *SD* below the mean), $\beta = .50$, $p < .001$, but household chaos was not associated with internalizing problems when children demonstrated high self-regulation (i.e., self-regulation 1 *SD* above the mean), $\beta = -.11$, $p > .05$. The RoS X values -1.23 and $.50$ suggested that the pattern of this interaction fit with the differential susceptibility framework.

In a separate analysis of internalizing problems with the same main effects and covariates but including child self-regulation at 24 months as the moderator, the household chaos x self-regulation interaction term was also statistically significant, with the same pattern of simple slopes (see Table 6 and Figure 4). Furthermore, the RoS X values -1.26 and $.21$ suggested that the pattern of this interaction fit with the differential susceptibility framework.

Discussion

The present study examined children's self-regulation skills as a mitigating factor in the relation between household chaos and behavior problems. Children's self-regulation and behavior problems were assessed longitudinally in a low-income, diverse sample of families. The first goal was to examine the strength and consistency of associations between household chaos and children's externalizing and internalizing problems during early childhood. In line with prior research, household chaos was significantly correlated with externalizing and internalizing problems at both 24 and 36 months. However, household chaos was not significantly correlated with self-regulation. Also, in multiple regression analyses that accounted for several covariates, household chaos no longer had a significant direct association with behavior problems.

The study's second goal was to investigate the role of self-regulation in associations between household chaos and children's behavior problems. Interestingly, there were no significant direct associations between self-regulation and behavior problems. However, and in line with hypotheses, self-regulation moderated the association between household chaos and behavior problems. There was a positive association between household chaos and

externalizing and internalizing problems, but only for children with poor self-regulation. For children who demonstrated more self-regulation during the waiting tasks, there was no link between household chaos and externalizing problems, suggesting that self-regulation functioned as a protective factor for these children. The same pattern of findings was uncovered for internalizing problems. Moreover, the same moderating pattern was supported with self-regulation at both 24 and 36 months, which is especially striking because self-regulation was only weakly (and non-significantly) correlated across time.

The moderation findings indicated that three out of four interactions were consistent with the differential susceptibility model (Belsky & Pluess, 2009). This model asserts that specific characteristics make children disproportionately more susceptible to environmental experiences, and a large proportion of the differential susceptibility literature has focused on negative affectivity or difficult temperament. For example, in a longitudinal examination, Pluess and Belsky (2010) found evidence for differential susceptibility to child care environments in early childhood when predicting cognitive and social outcomes in 6th grade. Children who demonstrated a difficult temperament in infancy had poorer outcomes when exposed to poor quality parenting and child care compared to children with easy temperaments. Yet, children with difficult temperament also benefitted from high-quality parenting and child care. In another study that is especially relevant to the present findings, children with low self-regulation reared in homes with higher levels of positive parenting experienced fewer externalizing problems than other youth, with a cross-over interaction pattern similar to the current study's findings (Kim-Spoon et al., 2012). Though self-regulation and difficult temperament are distinct constructs, Kim-Spoon and colleagues noted that low self-regulation might be an indicator of a highly responsive nervous system that is sensitive to context, which is one of the hallmarks of the differential susceptibility model. Their interpretation of low self-regulation seems particularly relevant to the current study where self-regulation was assessed during waiting tasks that were designed to be frustrating.

The present study also expands the literature on child development in chaotic home environments, in that chaos interacted with children's self-regulation to predict both internalizing and externalizing problems. The majority of research connecting chaos to child behavior has established links to externalizing problems, but very few studies have examined links between household chaos and internalizing problems. The present findings may also help clarify some of the inconsistencies in the prior literature, such as Dumas and colleagues' (2005) findings that household chaos was not associated with internalizing problems within their sample of preschool-aged children, which they attributed to the children's young age. It may be that young children are not uniformly at-risk for behavior problems when living in chaotic home environments, but children with low self-regulation skills are more likely to manifest this risk. Further research is needed to examine the interplay between self-regulation and chaos in risk for behavior problems over the course of development, keeping in mind the nuances of longitudinal changes in individual risk and protective factors.

Notably, we did not find evidence for direct associations between household chaos and self-regulation, which means that self-regulation did not function a mediator of links between

household chaos and behavior problems. Our findings are not entirely consistent with prior research that has supported direct links between indicators of household chaos and aspects of young children's self-regulation (Brown, Ackerman, & Moore, 2013; Martin, Razza, & Brooks-Gunn, 2012). One potential explanation for the present study's pattern of findings is that the unique nature of our sample (i.e., a high risk group of primarily African-American families with young mothers) may have reduced the variance in key variables of interest and restricted the range of the environmental context. Another explanation for the pattern of findings relates to the nature of early self-regulation development. Self-regulation skills develop rapidly across toddlerhood (Kopp, 1989), and perhaps household chaos does not directly interfere with self-regulation skills until later in the preschool period or into the school-age years. Thus, observed self-regulation across toddlerhood could be driven largely by the child's temperament, which would fit with its role as a moderator rather than a mediator of associations between household chaos and behavior problems. However, it is also noteworthy that self-regulation at 24 months was not significantly correlated with self-regulation at 36 months, which may be due to the rapid development of self-regulation across time and the somewhat different task demands at each wave of data collection.

Study Limitations

Though the present study furthers the research literature on household chaos, there are limitations to consider. First, this study did not fully capture the diversity in early childhood experiences within this at-risk population, including potentially chaotic experiences outside of the home. Some children may travel frequently with busy parents or spend most of their time outside of the home in various environments (e.g., with other family members, in childcare centers). Future research could examine the impact of chaos among children who spend extended time in outside-of-the-home contexts. Another limitation stems from the fact that all participants live in a similar environment. Young mothers living in other settings, or those who have more financial resources, may be more likely to provide organized, consistent, and nurturing environments for their children. Further research in broader contexts may generalize findings regarding self-regulation and household chaos found in the present study. Finally, although this study was multi-method in the sense that we used both parent report and structured observation to assess constructs, we assessed each construct with a single method. More specifically, we relied on maternal report of household chaos and child behavior problems, and we measured self-regulation with relatively brief observational tasks. Specific self-regulation behaviors were measured during the tasks, which were designed to be mildly frustrating. However, we did not code discrete emotions to capture emotion regulation more specifically. In addition, including informant reports of children's self-regulation or less emotionally-laden tasks would have allowed us to capture a broader range of self-regulation skills.

Applied Implications

The current study's findings suggest that interventions that focus on promoting adaptive self-regulation skills may help to ameliorate the potential negative effects of chaotic home environments. Given that socioemotional difficulties have long-term implications for social relationships, academic performance, and psychological functioning (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Trentacosta & Fine, 2010; Voltmer & von Salisch, 2017),

there have been significant research efforts aimed at formulating and implementing interventions that promote children's self-regulation skills.

There are several interventions for young children that enhance socio-emotional competencies, including regulation skills, and the current findings provide insights into how existing programs could be modified or enhanced. For example, school-based interventions promote young children's self-regulation skills in a structured environment (i.e., preschool or Head Start). One program that has research support is the Tools of the Mind preschool curriculum (Bodrova & Leong, 2007). Tools of the Mind promotes self-regulation and executive function skills through imaginative play and self-regulatory language, and this program is especially effective for children who demonstrate externalizing behavior problems (Solomon et al., 2018). Another program that has demonstrated empirical support in Head Start and kindergarten settings is the Promoting Alternative Thinking Strategies (PATHS) program. Administered by teachers, the curriculum promotes self-regulation skills by fostering problem-solving, emotion management, and social skills (Domitrovich, Cortez, & Greenberg, 2007). Although the PATHS program does not directly focus on self-regulation to the same extent as Tools of the Mind, the promotion of problem-solving, emotion management, and social skills can bolster underlying self-regulation processes. The present findings suggest that school-based programs that foster the self-regulatory skills of children from chaotic households may improve their adaptation to the preschool context and mitigate some of the behavioral risks associated with their turbulent home environment.

Given that the current findings and related research indicate that young children may experience negative behavioral effects of household chaos before they enter preschool, interventions that take place in the home environment early in life are especially relevant. Such family-based interventions may support children's regulation indirectly by improving parenting practices that promote the socialization of regulation, and by enhancing parents' own self-regulatory skills (Bernier et al., 2010; Gross et al., 2003). For example, attachment-based interventions increase socioemotional competence in toddlers and preschool-aged children by enhancing the parent-child relationship (National Scientific Council on the Developing Child, 2004). In addition, the Family Check-Up (FCU) model, which uses motivational interviewing to encourage parents to modify parenting practices and engage in goal-oriented behaviors, has been shown to foster inhibitory control in young children from at-risk families (Chang et al., 2014). Home-based programs, including the FCU, could be enhanced to directly target household chaos by attending to parents' motivation to increase structure and routines in daily life.

In conclusion, findings from the present study provide important insights into the development of internalizing and externalizing problems for children living in chaotic home environments. Children who demonstrate poor self-regulation skills may be especially susceptible to household chaos. Given that self-regulation has been associated with several positive outcomes across the lifespan, the results of the present study have implications for how to promote adaptive development and prevent behavior problems among at-risk young children.

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Highlights

- Household chaos was correlated with behavior problems across early childhood.
- Self-regulation consistently mitigated vulnerability to household chaos.
- Self-regulation moderated when predicting internalizing and externalizing problems.
- The findings have implications for preventive intervention at school and at home.

Figure 1.
Interaction between Household Chaos and Self-Regulation at 36 months Predicting
Externalizing Problems

Figure 2.
Interaction between Household Chaos and Self-Regulation at 24 months Predicting
Externalizing Problems

Figure 3.
Interaction between Household Chaos and Self-Regulation at 36 months Predicting
Internalizing Problems

Figure 4.
Interaction between Household Chaos and Self-Regulation at 24 months Predicting
Internalizing Problems

Table 1

Means, Standard Deviations, and Range of Scores for Study Variables

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	Range
Covariates:				
Externalizing (24 months)	100	14.44	8.40	0 – 39
Internalizing (24 months)	100	9.43	7.40	0 – 45
Maternal Depressive Symptoms	102	5.91	6.52	0 – 35
Positive Parenting	100	38.00	6.3	19.50 – 52.50
Household Chaos	85	1.61	2.12	1 – 12
Self-Regulation:				
24 months	100	.00	.33	–.62 – .38
36 months	85	.00	.31	–.69 – .31
Outcomes:				
Externalizing (36 months)	85	13.76	8.66	0 – 35
Internalizing (36 months)	85	9.46	9.15	0 – 60

Table 2

Bivariate Correlations

Variables	1	2	3	4	5	6	7	8	9
1. Child Sex									
2. Externalizing Problems (24 Months)	-.02								
3. Internalizing Problems (24 Months)	.04	.68**							
4. Maternal Depressive Symptoms	-.01	.43**	.51**						
5. Positive Parenting	.08	-.05	-.14	-.14					
6. Household Chaos	.12	.36**	.33**	.54**	-.08				
7. Self-Regulation (24 months)	-.02	-.17	.00	.06	-.03	.16			
8. Self-Regulation (36 months)	.13	-.02	-.01	.05	.02	-.07	.19		
9. Externalizing Problems (36 months)	-.14	.11	.54**	.49**	-.16	.46**	-.05	-.11	
10. Internalizing Problems (36 months)	-.01	.21*	.57**	.51**	-.20	.46**	-.03	-.08	.74**

Note.

*
 $p < .05$.**
 $p < .01$.

Table 3

Multiple Regression Predicting Child Externalizing Problems at 36 months with Self-Regulation at 36 months as the Moderator

Predictor	<i>B</i>	<i>SE</i>	β
Step 1, Main Effects and Covariates:			
Externalizing Problems (24 months)	.62	.09	.58**
Child Sex	-.85	1.32	-.05
Maternal Depressive Symptoms	.21	.13	.15
Positive Parenting	-.10	.10	-.07
Household Chaos	.63	.37	.16
Self-Regulation (36 months)	-2.24	2.10	-.08
Step 2, Adding the Interaction Term:			
Externalizing Problems (24 months)	.62	.09	.59**
Child Sex	-.94	1.29	-.06
Maternal Depressive Symptoms	.27	.13	.19*
Positive Parenting	-.07	.10	-.05
Household Chaos	.62	.36	.15
Self-Regulation (36 months)	-1.73	2.08	-.06
Household Chaos x Self-Regulation	-1.89	.93	-.16*

Note.

*
 $p < .05$.

**
 $p < .01$.

Table 4:

Multiple Regression Predicting Child Externalizing Problems at 36 months with Self-Regulation at 24 months as the Moderator

Predictor	<i>B</i>	<i>SE</i>	β
Step 1, Main Effects and Covariates:			
Externalizing Problems (24 months)	.65	.10	.61**
Child Sex	-.95	1.31	-.06
Maternal Depressive Symptoms	.19	.13	.13
Positive Parenting	-.09	.10	-.07
Household Chaos	.60	.38	.15
Self-Regulation (24 months)	1.80	2.07	.07
Step 2, Adding the Interaction Term:			
Externalizing Problems (24 months)	.64	.09	.60**
Child Sex	-1.46	1.26	-.09
Maternal Depressive Symptoms	.29	.13	.20*
Positive Parenting	-.07	.09	-.05
Household Chaos	.82	.36	.21*
Self-Regulation (24 months)	.96	1.98	.04
Household Chaos x Self-Regulation	-3.52	1.16	-.24**

Note.

* $p < .05$.

** $p < .01$.

Table 5

Multiple Regression Predicting Child Internalizing Problems at 36 months with Self-Regulation at 36 months as the Moderator

Predictor	<i>B</i>	<i>SE</i>	<i>β</i>
Step 1, Main Effects and Covariates:			
Internalizing Problems (24 months)	.56	.13	.40**
Child Sex	.69	1.60	.04
Maternal Depressive Symptoms	.37	.16	.24*
Positive Parenting	-.16	.12	-.11
Household Chaos	.76	.45	.18
Self-Regulation (36 months)	-2.30	2.57	-.08
Step 2, Adding the Interaction Term:			
Internalizing Problems (24 months)	.50	.12	.36**
Child Sex	.41	1.51	.02
Maternal Depressive Symptoms	.50	.16	.33**
Positive Parenting	-.11	.11	-.08
Household Chaos	.78	.42	.18
Self-Regulation (36 months)	-1.35	2.44	-.05
Household Chaos x Self-Regulation	-3.57	1.10	-.27**

Table 6

Multiple Regression Predicting Child Internalizing Problems at 36 months with Self-Regulation at 24 months as the Moderator

Predictor	<i>B</i>	<i>SE</i>	<i>β</i>
Step 1, Main Effects and Covariates:			
Internalizing Problems (24 months)	.55	.13	.40**
Child Sex	.43	1.59	.02
Maternal Depressive Symptoms	.35	.16	.23*
Positive Parenting	-.17	.12	-.12
Household Chaos	.89	.45	.21
Self-Regulation (24 months)	-2.05	2.37	-.07
Step 2, Adding the Interaction Term:			
Internalizing Problems (24 months)	.51	.13	.37**
Child Sex	-.23	1.53	-.01
Maternal Depressive Symptoms	.48	.16	.31**
Positive Parenting	-.14	.11	-.10
Household Chaos	1.17	.44	.27**
Self-Regulation (24 months)	-3.04	2.28	-.11
Household Chaos x Self-Regulation	-4.22	1.42	-.27**

Note.

*
 $p < .05$.

**
 $p < .01$.